

# REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words)  The Princeton Ocean Model (POM), that already includes most of the model features described in the proposal, has been chosen for this modeling task. The latest version of the POM code has been installed and optimized to run on the IBM9672-R53 mainframe at LSU. Significant efforts have been devoted to developing and modifying various software to be used for the analysis of model output. After examining all the available bathymetric data sets of the region, it was decided to digitize the nautical charts published by the Defense Mapping Agency in order to resolve important hydrodynamic features at the Strait of Bab al Mandab. This task has been initiated, and it is expected to be completed in the next two months. Presently, we are testing the POM code configured for a preliminary test domain based on the ETOP05 data. This test domain extends from 11.5°N to 14°N and from 42°E to 44.5°E, and has at least 2 km horizontal resolution and 11 levels in the vertical. The initial test includes testing sensitivity of various open boundary conditions which could be used along the northern and the southern open boundaries located in the Red Sea and in the Gulf of Aden, respectively.					
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### Task B: Modeling

The Princeton Ocean Model (POM), that already includes most of the model features described in the proposal, has been chosen for this modeling task. The latest version of POM (1997 version) has been downloaded from the POM web site in Princeton. The POM code has been installed and optimized to run on the IBM9672-R53 mainframe with five processors located at the Systems Network Computer Center at LSU. Significant efforts have been devoted to developing and modifying various software to be used for analysis of model output. Specifically, the software package which has been tailored to work with the POM code includes NCAR graphics, GASP, a 2-D computer animation software developed at the Florida State University, and DataViz, a 3-D computer animation software developed at our own laboratory.

In order to resolve important hydrodynamic features at the Strait of Bab al Mandab, it is our intention to use horizontal model grid of at least 1 km. To obtain detailed bottom bathymetric data necessary to set up a model domain, initially, ETOP05 world topography data set was examined. With its 1/12 degree resolution, this data set does not appear to resolve many significant bottom and coastal topographic features visible in the nautical charts published by Defense Mapping Agency (available from NOAA National Ocean Service). The resolution of the bottom bathymetric contour data set published by British was also judged to be insufficient for our purpose. Therefore, it was decided to digitize the nautical charts published by the Defense Mapping Agency. This task has been initiated, and it is expected to be completed in the next two months. Currently, we are testing the POM code configured for a preliminary test domain based on the ETOP05 data. This test domain extends from 11.5°N to 14°N and from 42°E to 44.5°E, and has at least 2 km horizontal resolution and 11 levels in the vertical. We are also testing two different grid systems, namely, rectilinear and curvilinear coordinate systems.

The initial test includes sensitivity test of various open boundary conditions which could be used along the northern and the southern open boundaries located in the Red Sea and in the Gulf of Aden, respectively. The open boundary conditions being tested include radiation conditions (e. g., Orlanski, and Camerlengo and O'Brien conditions) and flow relaxation conditions.

In the second year, various numerical "process" experiments pertinent to the region will be carried out. These include "lock experiment" and "tide experiment." The emphasis will be to examine the roles of various forcing functions in affecting the flow through the strait. In carrying out those experiments, additional refinements of the open boundary conditions will be necessary. Initially, water mass properties based on Levitus climatology will be used to define water mass characteristics on both sides of the strait. Later experiments will utilize water mass characteristics identified by the hydrographic data collected under Task A. The initial set of experiments is a "lock experiment," whereby the northern and the southern basins are filled with respective water masses representing the Red Sea and the Gulf of Aden with a lock separating the two water masses. Adjustment process after the lock is lifted will be studied using the model. In "tide experiments", tides of realistic amplitudes will be imposed at both ends of the model domain to

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represent tides coming in from the Red Sea and the Gulf of Aden. One of the exciting findings of the field program under Task A is the discovery of rapid response of the throughflow transport at the strait to barotropic pressure gradient setup by abrupt wind changes. Additional experiments are being planned to study this phenomenon.